March 29, 2006

ORGANIZATION: PEBBLE BED MODULAR REACTOR (PTY) LTD.

PROJECT: PEBBLE BED MODULAR REACTOR PRE-APPLICATION REVIEW

SUBJECT: SUMMARY OF PUBLIC MEETING WITH PEBBLE BED MODULAR REACTOR (PTY) LTD. REGARDING SAFETY DESIGN AND ANALYSIS, AND PLANT OPERATIONS AND EVENTS OF THE PBMR

The U.S. Nuclear Regulatory Commission (NRC) staff met with representatives from Pebble Bed Modular Reactor (Pty) Ltd. on March 15 and 16, 2006, to discuss safety design & analysis, and plant operations and events for the Pebble Bed Modular Reactor (PBMR). The purpose of the meeting was to familiarize NRC staff with the PBMR design and safety analysis, in support of future white papers that will be submitted to NRC for design certification pre-application review. The meeting notice with agenda was published on February 14, 2006 (ML060450624). The meeting was a continuation of a previous set of familiarization sessions held from February 28-March 2, 2006 (ML060750199). PBMR requested these meetings on February 2, 2006 (ML060370388) pursuant to a plan transmitted by letter dated December 8, 2005 (ML053420601) and discussed at the public meeting on December 12, 2005 (ML053630306).

The meeting was a Category 1 meeting and observed by the public and interested stakeholders. The attendance list for the meeting is shown as Enclosure 1 and the agenda is included as Enclosure 2. PBMR's meeting handouts can be accessed through the Agencywide Documents Access and Management System (ADAMS) under Accession No. (ML060790546). If you do not have access to ADAMS or if there are problems in accessing the handouts located in ADAMS, contact the NRC Public Document Room (PDR) reference staff at 1-800-397-4209, 301-415-4737 or by e-mail to pdr@nrc.gov.

The following areas of the PBMR design and operation were discussed in the meeting:

(1) Safety and Design Familiarization - PBMR reiterated their objectives for the pre-application process.

(2) Plant Operations and Maintenance Overview - Information was provided on the operating envelope, modes, transitions, transients, and maintenance principles.

(3) Radioactivity Releases from PBMR Fuel - Information was provided on the technical bases for the mechanistic model PBMR proposes to use to predict fission product releases.

(4) Safety Design Approach - Information was provided about what PBMR considers to be important paradigm shifts regarding the plant design and the safety approach. More details were provided about active and passive systems, and their expected contributions to safety.

(5) PBMR Event Sequence Framework - Information was provided about the framework for

identifying event sequences consistent with the safety design philosophy. Comparisons were provided with LWR practice for constructing event sequences for a PRA. The PBMR PRA appears to play a central role in the design and safety analysis of the plant.

(6) PBMR Response to Events - Information was provided about scenarios that result from selected initiating events, and the expected plant responses. The process involves construction of event trees to project end states.

(7) Wrap-up - PBMR and NRC staff discussed the expected next steps, with the understanding that the white papers are projected to be submitted on schedule beginning in May 2006. NRC reiterated the resource constraints facing the staff.

The NRC staff discussed several issues with PBMR to better understand the design and operation of the plant, and the approach that PBMR will be using to address technical, regulatory and policy issues. The following issues were discussed with PBMR:

- Type and location of instrumentation included in the PBMR design.

- Relevance of the German pebble-bed experience given that PBMR is a different reactor design basis for selective use of German data for application to PBMR. Comparison between the helium coolant velocities between the German pebble-bed experience and PBMR.

- Sources for data such as emissivity of the pebbles, failure probabilities for the PRA, or plate-out and lift-off of radionuclides.

- The basis for distinguishing safety from non-safety functions.

- The basis for incorporating redundancy and diversity into the design.

- Application of structuralist and rationalist principles employed for addressing defense-in-depth.

The NRC staff provided several insights to PBMR as follows:

- The presentations during the familiarization sessions discussed parameter limits but did not cover acceptance criteria for operational decision making. Acceptance criteria should be addressed in the white papers.

- The German data on fuel particle performance has significance for PBMR because they are the basis for estimating the mechanistic radioactive source term in the scenarios described. Adequate proof is needed for any assertion that the level of stress in PBMR fuel would be significantly less than that which occurred during the German tests.

- The PBMR design does not appear to uniformly employ the single failure criterion in the same way as required by the existing regulations. This is likely to be a challenging regulatory issue for the staff.

- The description of the safety analyses appear to indicate that both conservative methods as well as best-estimate-with-uncertainties methods are employed by PBMR. The technical appropriateness of each approach should be clarified.

Please direct inquiries regarding this meeting to N. Prasad Kadambi at 301-415-5896, or npk@nrc.gov.

/RA/

N. Prasad Kadambi, Project Manager
New & Advanced Reactors Branch
Division of Risk Assessment & Special Projects
Office of Nuclear Regulatory Research

Project No. 732

Enclosures: 1. Lists of Attendees
2. Agenda

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NRC/PBMR PUBLIC MEETING
WEDNESDAY, MARCH 15, 2006 9:00 A.M. TO 5:00 P.M., O-7 B4
ATTENDANCE

NAME	AFFILIATION
David Whittal	AREVA NP
Farshid Shahrokhi	AREVA NP
Johan Venter	PBMR
Tom Kress	ACRS
Yuri Orechwa	NRC/NRR
Stu Rubin	NRC/RES
Jerry Chuang	NRC/NMSS
Chris Brown	NRC/NRR
Bob Einziger	NRC/NMSS
Mark Holbrook	Idaho National Laboratory
Kent Welter	NRC/RES
Steve Frantz	Morgan Lewis
Tony Attard	NRC/NRR
Paul Clifford	NRC/NRR
John N. Ridgely	NRC/RES
Charles Interrante	NRC/NMSS
Charles Kling	PBMR/Westinghouse
Stan Ritterbusch	PBMR/Westinghouse
Fred Silady	PBMR
Karl Fleming	PBMR
Hans-Wolfgang Chi	PBMR
Ed Wallace	PBMR
Christiana Lui	NRC/RES
Michael Waters	NRC/RES
Martin Stutzke	NRC/RES
Albert Tardiff	USNRC/NSIR
Walton Jenson	NRC/NRR/DSS

NRC/PBMR PUBLIC MEETING
THURSDAY, MARCH 16, 2006 9:00 A.M. TO 5:00 P.M.
ATTENDANCE

NAME	AFFILIATION
Jim Kim	NRC/NRR
Ed Wallace	PBMR
Farshid Shahrokhi	AREVA-NP
Steve Frantz	Morgan Lewis
Chuck Klling	PBMR/Westinghouse
Edward Burns	PBMR
Fred Silady	PBMR
Martin Stutzke	NRC/NRR
Yuri Orechwa	NRC/NRR
Paul Clifford	NRC/NRR
Tom Kress	ACRS
John N. Ridgely	NRC/RES
Donald E. Carlson	NRC/RES
David Whittal	AREVA-NP
Karl Fleming	PBMR
Han-Wolfgang Chi	PBMR
Stan Ritterbusch	PBMR/Westinghouse
Mark Holbrook	Idaho National Laboratory
B. P. Jain	NRC/RES
Kent B. Welter	NRC/RES
Stu Rubin	NRC/RES
Kris Parczewski	NRC/NRR
Sud Basu	NRC/RES

PBMR Safety and Design Familiarization

Session 2 - Safety design and analysis, and plant operations and events

Wednesday, March 15, 2006, **Room O-7 B4**

9:00 a.m. Introductory Remarks

9:15 a.m. Plant Operations Overview

10:15 a.m. Operating Conditions and Modes

10:30 a.m. Break

10:45 a.m. Fuel

12:15 a.m. Lunch

1:15 p.m. Safety Design Approach

2:15 p.m. Top Level Regulatory Criteria (TLRC)

3:15 p.m. Break

3:30 p.m. Open Discussion

Thursday, March 16, 2006, **Room O-7 B4**

9:00 a.m. Integrated Deterministic and Probabilistic Safety Analysis Approach

10:30 a.m. Break

10:45 a.m. Integrated Deterministic and Probabilistic Safety Analysis Approach (Cont'd)

12:15 p.m. Lunch

1:15 p.m. Event Identification and Categorization

2:15 p.m. Event Analysis

3:15 p.m. Break

3:30 p.m. Risk Analysis

4:00 p.m. Wrap-up Discussions PBMR Design Familiarization Sessions – Agenda 20060202_3